What is claimed:

1. A communication system for providing a plurality of user networks with a high speed link to a wide area network comprising:

a transport network having a plurality of network nodes coupled together by one or more data communication paths, wherein at least one of said network nodes comprises an access device and at least one of said network nodes comprises a concentrator device;

said access device including a plurality of router port extension functional units wherein each said router port extension functional unit is coupled to one of the user networks, said router port extension functional unit being operable to receive an upstream data packet from one of the user networks, operable to frame said received upstream data packet into a format compatible for transmission on said transport network, and operable to forward said converted upstream data packet onto at least one of said one or more data communication paths on said transport network, said router port extension functional unit also being operable to receive a downstream data packet from at least one of said one or more data communication paths on said transport network, operable to frame said received downstream data packet into a format compatible for receipt by said user network, and operable to forward said converted downstream data packet to said user network; and

said concentrator device being coupled to a wide area network access device, said concentrator device being operable to receive network data packets from at least one of said data communication paths and operable to forward said received network data packets to said wide area network access device, said concentrator device also being operable to receive data packets from said wide area network access device and operable to forward said data packets from said wide area network access device to at least one of said data communication paths.

2. The system according to claim 1 wherein each of the router port extension functional units has an associated virtual port and wherein all of said virtual ports are multiplexed to a single LAN communication port.

3. The system according to claim 2 further comprising a LAN switch device, said LAN switch device having a first port for providing a coupling path to said LAN communication port of said access device, said LAN switch also having a plurality of customer LAN ports, each of said customer LAN ports being operable to provide a coupling point for a connection between one of the user LANs and one of the router port extension functional units.

4. The system according to claim 3 wherein said LAN switch device provides virtual channels between the user LANs and said router port extension functional units.

5. The system according to claim 3 wherein said LAN switch device provides a virtual LAN for providing a connection between the user LANs and said router port extension functional units.

6. The system according to claim 5 wherein each of said user LANs is provided with a unique virtual LAN identification number.

7. The system according to claim 1 wherein said router port extension functional units comprise:

a virtual channel agent that is operable to receive said downstream data packet from said transport network, said virtual channel agent also being operable to transmit said upstream data packet to said transport network; and

a LAN agent that is operable to receive said upstream data packet from the user netork, said LAN agent also being operable to transmit said downstream data packet to the user network.

8. The system according to claim 7 wherein said virtual channel agent further comprises:

a virtual channel framer that is operable to frame said upstream data packet into a format that is compatible for transmission on said transport network; and

a virtual channel de-framer that is operable to remove a network encapsulation format from said downstream data packet that has been receive from said transport network.

9. The system according to claim 7 wherein said LAN agent further comprises:

a LAN framer that is operable to frame said downstream data packet into a frame format that is compatible for transmission to the user network;

an encapsulation detector that is operable to detect said frame format used by the user network to transfer data packets; and

a LAN filter that is operable to determine whether a received data packet is addressed to said router port extension functional unit.

10. The system according to claim 9 wherein said LAN agent is an Ethernet LAN agent, said LAN framer is an Ethernet framer and said LAN filter is a MAC filter.

11. The system according to claim 7 wherein said router port extension functional unit further comprises:

a router agent for routing data packets within said router port extension functional unit;

an address resolution agent that is operable to process ARP-like messages;

an address resolution database that is operable to store LAN addresses;

an IRDP-like agent that is operable to process IRDP-like messages; and

a RIP-like agent that is operable to process RIP-like messages.

12. The system according to claim 11 wherein said address resolution agent is an ARP agent that is operable to process ARP messages and said address resolution database is an ARP database that is operable to store LAN addresses.

13. The system according to claim 11 wherein said IRDP-like agent is an IRDP agent that is operable to process IRDP messages.

14. The system according to claim 11 wherein said RIP-like agent is a RIP agent that is operable to process RIP messages.

15. The system according to claim 1 wherein said network is an optical network.

16. The system according to claim 1 wherein said network is a ring network.

17. The system according to claim 15 wherein said network is an hub and spoke network.

18. The system according to claim 16 wherein said ring network is a SONET or SDH ring.

19. A network node device for use in a transport network and for providing a plurality of user networks with an interface to the transport network, the network node device comprising a plurality of router port extension functional units, each router port extension functional unit being coupled to one of the user networks, each router port extension functional unit comprising:

a virtual channel agent that is operable to receive a first data packet from the transport network, said virtual channel agent also being operable to transmit a second data packet to the transport network; and

a LAN agent that is operable to receive said second data packet from the user network, said LAN agent also being operable to transmit said first data packet to the user network.

20. The network node device according to claim 19 wherein each of the router port extension functional units has an associated virtual port and wherein all of said virtual ports are multiplexed to a single LAN communication port.

21. The network node device according to claim 19 wherein said virtual channel agent comprises:

a virtual channel framer that is operable to frame said second data packet into a format that is compatible for transmission on the transport network; and

a virtual channel de-framer that is operable to remove a network encapsulation format from said first data packet.

22. The network node device according to claim 19 wherein said LAN agent comprises:

a LAN framer that is operable to frame said first data packet into a LAN frame format that is compatible for transmission to the user network;

an encapsulation detector that is operable to detect the LAN frame format used by the user equipment to transfer data packets; and

a LAN filter that is operable to determine whether a received data packet is addressed to the router port extension functional unit.

23. The network node device according to claim 22 wherein said LAN agent is an Ethernet LAN agent, said LAN framer is an Ethernet framer and said LAN filter is a MAC filter.

24. The network node device according to claim 19 wherein said router port extension functional unit further comprises:

a router agent for routing said first and said second data packets within the router port extension functional unit;

an address resolution agent that is operable to process ARP-like messages;

an address resolution database that is operable to store LAN addresses;

an IRDP-like agent that is operable to process IRDP-like messages; and

a RIP-like agent that is operable to process RIP-like messages.

25. The network node device according to claim 24 wherein said address resolution agent is an ARP agent that is operable to process ARP messages and said address resolution database is an ARP database that is operable to store LAN addresses.

26. The network node device according to claim 24 wherein said IRDP-like agent is an IRDP agent that is operable to process IRDP messages.

27. The network node device according to claim 24 wherein said RIP-like agent is a RIP agent that is operable to process RIP messages.

28. A transport network access system for use in a transport network and for providing a plurality of user networks with an interface to the transport network, the network access system comprising a plurality of router port extension functional units, each router port extension functional unit being coupled to one of the user networks, each router port extension functional unit comprising:

a virtual channel agent that is operable to receive a first data packet from the transport network, said virtual channel agent also being operable to transmit a second data packet to the transport network; and

a LAN agent that is operable to receive said second data packet from the user network, said LAN agent also being operable to transmit said first data packet to the user network.

29. The network access system according to claim 28 wherein each of the router port extension functional units has an associated virtual port and wherein all of said virtual ports are multiplexed to a single LAN communication port.

30. The system according to claim 29 further comprising a LAN switch device, said LAN switch device having a first port for providing a coupling path to said LAN communication port of said access device, said LAN switch also having a plurality of customer LAN ports, each of

said customer LAN ports being operable to provide a coupling point for a connection between one of the user LANs and one of the router port extension functional units.

31. The system according to claim 30 wherein said LAN switch device provides virtual channels between the user LANs and said router port extension functional units.

32. The system according to claim 30 wherein said LAN switch device provides a virtual LAN for providing a connection between the user LANs and said router port extension functional units.

33. The system according to claim 32 wherein each of said user LANs is provided with a unique virtual LAN identification number.

34. The system according to claim 28 wherein said virtual channel agent further comprises:

a virtual channel framer that is operable to frame said upstream data packet into a format that is compatible for transmission on said transport network; and

a virtual channel de-framer that is operable to remove a network encapsulation format from said downstream data packet that has been receive from said transport network.

35. The system according to claim 28 wherein said LAN agent further comprises:

a LAN framer that is operable to frame said downstream data packet into a frame format that is compatible for transmission to the user network;

an encapsulation detector that is operable to detect said frame format used by the user network to transfer data packets; and

a LAN filter that is operable to determine whether a received data packet is addressed to said router port extension functional unit.

36. The system according to claim 35 wherein said LAN agent is an Ethernet LAN agent, said LAN framer is an Ethernet framer and said LAN filter is a MAC filter.

37. The system according to claim 28 wherein said router port extension functional unit further comprises:

a router agent for routing data packets within said router port extension functional unit;

an address resolution agent that is operable to process ARP-like messages;

an address resolution database that is operable to store LAN addresses;

an IRDP-like agent that is operable to process IRDP-like messages; and

a RIP-like agent that is operable to process RIP-like messages.

38. The system according to claim 37 wherein said address resolution agent is an ARP agent that is operable to process ARP messages and said address resolution database is an ARP database that is operable to store LAN addresses.

39. The system according to claim 37 wherein said IRDP-like agent is an IRDP agent that is operable to process IRDP messages.

40. The system according to claim 37 wherein said RIP-like agent is a RIP agent that is operable to process RIP messages.

41. The system according to claim 28 wherein said transport network is an optical network.

42. The system according to claim 28 wherein said transport network is a ring network.

43. The system according to claim 28 wherein said transport network is an hub and spoke network.

44. The system according to claim 42 wherein said ring network is a SONET or SDH ring.

45. A method for use with a transport network access system comprising a plurality of router port extension functional units, the transport network access system being coupled to a tranport network, each router port extension functional unit being coupled to one of a plurality of user networks, each router port extension functional unit comprising (a) a virtual

channel agent that is operable to receive a first data packet from the transport network, the virtual channel agent also being operable to transmit a second data packet to the transport network, and (b) a LAN agent that is operable to receive said second data packet from the user network, the LAN agent also being operable to transmit said first data packet to the user network, the method comprising the steps of:

receiving, with the LAN agent, an upstream data packet from the user equipment;

encapsulating, with the router port extension functional unit, said received upstream data packet into an encapsulation format that is compatible for transmission on said network; and

routing, with the virtual channel agent, said encapsulated data packet onto at least one of a plurality of data communication paths on the transport network for further transmission to a wide area network access device.

46. The method of claim 45 further comprising the steps of:

receiving, with the virtual channel agent, a downstream data packet from at least one of said plurality of data communication paths on said transport network;

encapsulating, with the router port extension functional unit, said received downstream data packet into an encapsulation format that is compatible for receipt by the user LAN; and

routing, with the LAN agent, said encapsulated downstream data packet to said user LAN.

47. The method of claim 46 wherein said user LAN interface is an Ethernet LAN.

48. The method of claim 45 wherein said received upstream data packet is an Ethernet format data packet.

49. The method of claim 45 wherein said transport network is a SONET or SDH ring and said encapsulating step comprises the step of encapsulating said received upstream data packet into a SONET or SDH format data packet.

50. The method of claim 45 wherein said routing step comprises the step of adding said encapsulated data packet to a virtual channel in the network.

51. The method of claim 46 wherein said network is a SONET or SDH ring and said downstream data packet is a SONET or SDH format data packet.

52. The method of claim 51 wherein said encapsulating said received downstream data packet step includes the step of removing a network encapsulation format from said received downstream data packet.

53. The method of claim 51 wherein said encapsulating said received downstream data packet step further includes the step of encapsulating said received downstream data packet into an Ethernet format data packet.

54. The method of claim 51 wherein said encapsulating said received downstream data packet step includes the steps of removing a network encapsulation format from said downstream data packet thereby de-framing said data packet and encapsulating said de-framed data packet into an Ethernet format data packet.

55. The method of claim 45 wherein said network is an optical network.

56. The method of claim 45 wherein said network is a ring network.

57. The method of claim 56 wherein said network is an IP ring network.

58. The method of claim 56 wherein said ring network is a SONET or SDH network.

59. A method for extending a plurality of sub-interfaces of a router port of a wide area network access device to a plurality of user networks using a transport network comprising a plurality

of network nodes coupled together by one or more data communication paths, wherein at least one of said network nodes comprises an access device, the access device including a plurality of router port extension functional units wherein each router port extension functional unit is coupled to one of the user networks, each router port extension functional unit comprising (a) a virtual channel agent and (b) a LAN agent, wherein each of the router port extension functional units has an associated virtual port and wherein all of said virtual ports are multiplexed to a single LAN communication port, the method comprising the steps of:

receiving, with the virtual channel agent of a first router port extension functional unit, a downstream data packet from the router port;

decapsulating , in said first router port extension functional unit, said received downstream data packet so that the transport network encapsulation format is removed from said received data packet;

transmitting, with the LAN agent of the first router port extension functional unit, an ARP-like message over a first user LAN requesting the address for the recipient of the received downstream data packet;

receiving, with the LAN agent of the first router port extension functional unit, an ARP-like response from a device on the first user LAN;

encapsulating, in the first router port extension functional unit, the decapsulated data packet into a LAN encapsulation format data packet using the address received from the ARP-like response as the destination address for the data packet;

transmitting, with the LAN agent of the first router port extension functional unit, the LAN encapsulated data packet onto said first user LAN; and

repeating the foregoing steps with a second user LAN using a second router port extension functional unit.

60. The method of claim 59 further comprising the following steps:

listening to, with the first router port extension functional unit, messages traveling across the first LAN;

determining, in the first router port extension functional unit, the encapsulation format used for data packets on the first LAN;

using, in the first router port extension functional unit, the determined encapsulation format type when encapsulating data packets for transmission onto the first LAN; and

repeating the foregoing steps with a second user LAN using a second router port extension functional unit

61. The method according to claim 59 wherein a LAN switch device having a first port is coupled to the LAN communication port of the access device via the first port, said LAN switch also having a plurality of customer LAN ports, each of said customer LAN ports being operable to provide a coupling point for a connection between one of the user LANs and one of the router port extension functional units.

62. The system according to claim 61 wherein said LAN switch device provides virtual channels between the user LANs and said router port extension functional units.

63. The system according to claim 61 wherein said LAN switch device provides a virtual LAN for providing a connection between the user LANs and said router port extension functional units.

64. The system according to claim 63 wherein each of said user LANs is provided with a unique virtual LAN identification number.

65. A method for extending a plurality of sub-interfaces of a router port of a wide area network access device to a plurality of user networks using a transport network comprising a plurality of network nodes coupled together by one or more data communication paths, wherein at least one of said network nodes comprises an access device, the access device including a plurality of router port extension functional units wherein each router port extension functional unit is coupled to one of the user networks, each router port extension functional unit comprising (a) a virtual channel agent and (b) a LAN agent, wherein each of the router port extension functional units has an associated virtual port and wherein all of said virtual ports are multiplexed to a single LAN communication port, the method comprising the steps of:

receiving, with the LAN agent of a first router port extension functional unit, a first upstream data packet from a first user LAN;

decapsulating, in the first router port extension functional unit, said received first data packet so that the LAN encapsulation format is removed from said received first data packet;

encapsulating, in the first router port extension functional unit, the first decapsulated data packet into the transport network encapsulation format;

transmitting, with the virtual channel agent of the first router port extension functional unit, the first transport network encapsulated data packet onto the transport network; and

repeating the foregoing steps with a second user LAN using a second router port extension functional unit